

# **The Changing World of Industrial and Specialty Electric Vehicles**

**The Second Annual Conference**

**August 18-20, 1999**

**The Hilton Hotel at**

**Walt Disney World Village**

**Lake Buena Vista, Florida**

**Exhibit I**

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**THE CHANGING WORLD OF  
INDUSTRIAL AND SPECIALTY ELECTRIC  
VEHICLES**

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# THE CHANGING WORLD OF INDUSTRIAL AND SPECIALTY ELECTRIC VEHICLES

## DAY 1 – Thursday, August 19, 1999

7:00      **Continental Breakfast & Registration**

7:45	<b>Welcome</b>	<i>Conference Chairman</i>	Gloria Krein, EPRI Bob Hawkins, Alabama Power (SoCo)
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8:00	<b>Keynote Speaker</b> <i>Emerging Business Opportunities in the New Millennium</i>		C.D. "Rapp" Rappleyea, Chairman & CEO New York Power Authority
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9:00	<b>Regulatory &amp; Incentives Update</b> The National Perspective The California Perspective Los Angeles Basin Incentive Program	<i>Moderator</i>	Coleen Tessema, SCE Kateri Callahan, EVAA Scott Rowland, CARB Michael Bogdanoff, SCAQMD
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10:30      **Break**

11:00	<b>Lift Truck Session</b> Material Handling Distributors Manufacturer's Perspective Manufacturer: New Technologies	<i>Moderator</i>	Don Caridas, AEP Liz Richards, MHEDA Tom Hoying, Crown Chris Goode, Clark
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12:30      **Luncheon/Exhibits**  
*Located in Exhibit Hall*

2:00	<b>Bridging Automotive Research</b> Automotive Controllers Solid State Devices Motors & Generators	<i>Moderator</i>	Bud Clark, C&SW Allan Gale, Ford Motor Company Fred Flett, International Rectifier Patrick J. McCleer, McCleer Power
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3:00      **Break**

3:15	<b>Batteries/Opportunity Charging</b>  Battery Update: Ovonic Battery Update: Yuasa Battery Life Testing 1998 Opportunity Charging Demo Projects Infrastructure Issues The Business Case for Fast Charging: Perspectives	<i>Moderator</i>	Bob Bellenger, Alabama Power (SoCo) Greg Fritz Karyl McKnight Naum Pinsky, SCE Gloria Krein, EPRI Ernie Morales, SCE Jay Gill, AeroVironment Stephen Schey, Edison Source
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5:30      **Reception**  
*Located in Exhibit Hall*

**DAY 2 – August 20, 1999**

7:00	<b>Continental Breakfast</b>		
7:45	<b>Welcome</b>	<i>Conference Chairman</i>	Bob Hawkins, Alabama Power (SoCo)
8:00	<b>Utility Vehicles, Neighborhood Vehicles and City Cars</b> Utility Vehicles  Neighborhood Vehicles  City Cars	<i>Moderator</i>	<i>Kerry-Jane King, NYPA</i>  Karl Thidemann, Solectria B. Samara, Taylor-Dunn Barry Cook, E-Z-GO Graham Hill, Global Elec. MotorCars Bryan Taylor, Bombardier James Geer, Ford Motor Company
10:30	<b>Break</b>		
11:00	<b>Outdoor Power Equipment Production</b> Use of Automated Guided Vehicles in Manufacturing Outdoor Equipment	<i>Moderator</i>	<i>Jerry Lonergan, KEURP</i> Larry Toraason, John Deere Mark Gebhardt, CORECON Engineered Solutions
11:30	<b>Scrubbers &amp; Sweepers</b> Commercial & Industrial Marketplace	<i>Moderator</i>	<i>DeJim Lowe, TVA</i> Mark Fleigle, Tennant Company
12:00	<b>Luncheon/Exhibits</b> <i>Located in Exhibit Hall</i>		
1:00	<b>Propulsion Systems</b> Applications to Non-Road Equipment	<i>Moderator</i>	<i>Sal Termini, CSW Total EV</i> Kevin Barnes, Unique Mobility
1:30	<b>Airports: Improved Technologies</b> John Wayne Airport United Airlines	<i>Moderator</i>	<i>Layla Sandell, EPRI</i> Scotty Stewart Ralph Timan
2:30	<b>Break</b>		
2:45	<b>Marketing Transfer</b> Green Pricing and the Non-Road Market	<i>Moderator</i>	<i>Alex Hapka, Kansas City P&amp;L</i> Terry Peterson, EPRI
3:15	<b>Bicycles &amp; Portable EVs</b> Bicycles Bicycles/Police Departments Successful Promotions	<i>Moderator</i>	<i>Tonya Shadduck, CSW Total EV</i> Richard Allen, EV Global East Kevin Moran, Smith & Wesson Tonya Shadduck, CSW Total EV
4:15	<b>Drawing/Adjournment</b>		Eric Heim, EPRI Bob Hawkins, Alabama Power (SoCo)

**KEVIN A. BARNES**  
**UNIQUE MOBILITY, INC.**

Kevin A. Barnes is the Manager of Product Sales at Unique Mobility, Inc. and is responsible for product and engineering services sales. Mr. Barnes also coordinates many of Unique's new business and product development programs.

While working for Unique, Mr. Barnes has been involved with many electric and hybrid/electric vehicle applications ranging from bicycles, scooters and wheelchairs to commuter cars and transit busses. Kevin joined Unique in 1988 where he was responsible for product development testing and pioneered Unique's involvement in solar racing and university electric and hybrid/electric vehicle competitions.

Mr. Barnes is a graduate of the Colorado School of Mines and holds a B.S. degree in power electronics and controls with a minor in alternative energy.

**Unique Mobility, Inc.**

***Driving the World  
with  
Electric Power***



# Company Profile



Corporate Headquarters, Golden CO

Developer and manufacturer of

- *brushless PM motors*,
- *electronic controls* and
- *precision gear sets*

for automotive, industrial  
and aerospace applications

- FY 1999 Sales: \$15.8 million
- Total assets: \$27.2 million
- Employees: 190
- Exchanges: American (AMEX:UQM), Berlin, Boston,  
Chicago, Frankfurt and Pacific

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**UQM**

# Corporate Structure



## ASIA



**Taiwan UQM Electric Co., Ltd.**

Tao-Yuan, Taiwan ROC  
JV & Licensee



## EUROPE

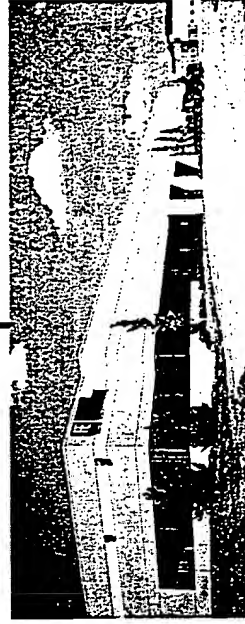
**Unique Mobility, Inc.**

Golden, Colorado

Product development

**Unique Mobility Europa GmbH**

Mittwieda, Germany  
JV & Licensee



**Unique Power Products, Inc.**

Frederick, Colorado

Motor & gear manufacturing

**Franklin Manufacturing Company**

St. Charles, Missouri

Electronics manufacturing



## **Mission**

**Build on Unique's technology base to**

**become a leading provider of advanced**

**vehicle power systems for energy**

**efficient, environmentally clean**

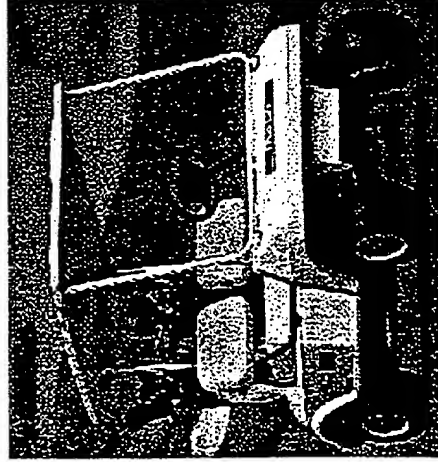
**transportation throughout the world.**

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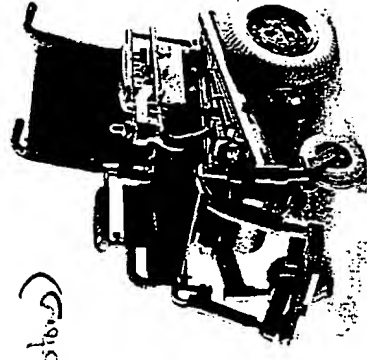
**UQM**

# Low Power Vehicles Existing Markets

2100 V  
230 Kw



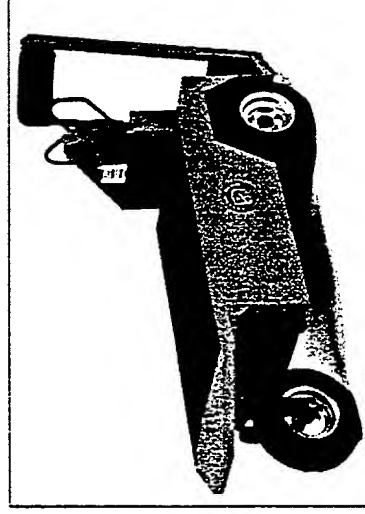
- Wheelchairs *Invacare (produced several thousand motors)*
- Golf carts
- Floor maintenance/sweepers
- Warehouse/utility vehicles
- Fork trucks
- Automated guide vehicles



## Today

Commodity propulsion systems

- Brush motors
- Lead-acid batteries

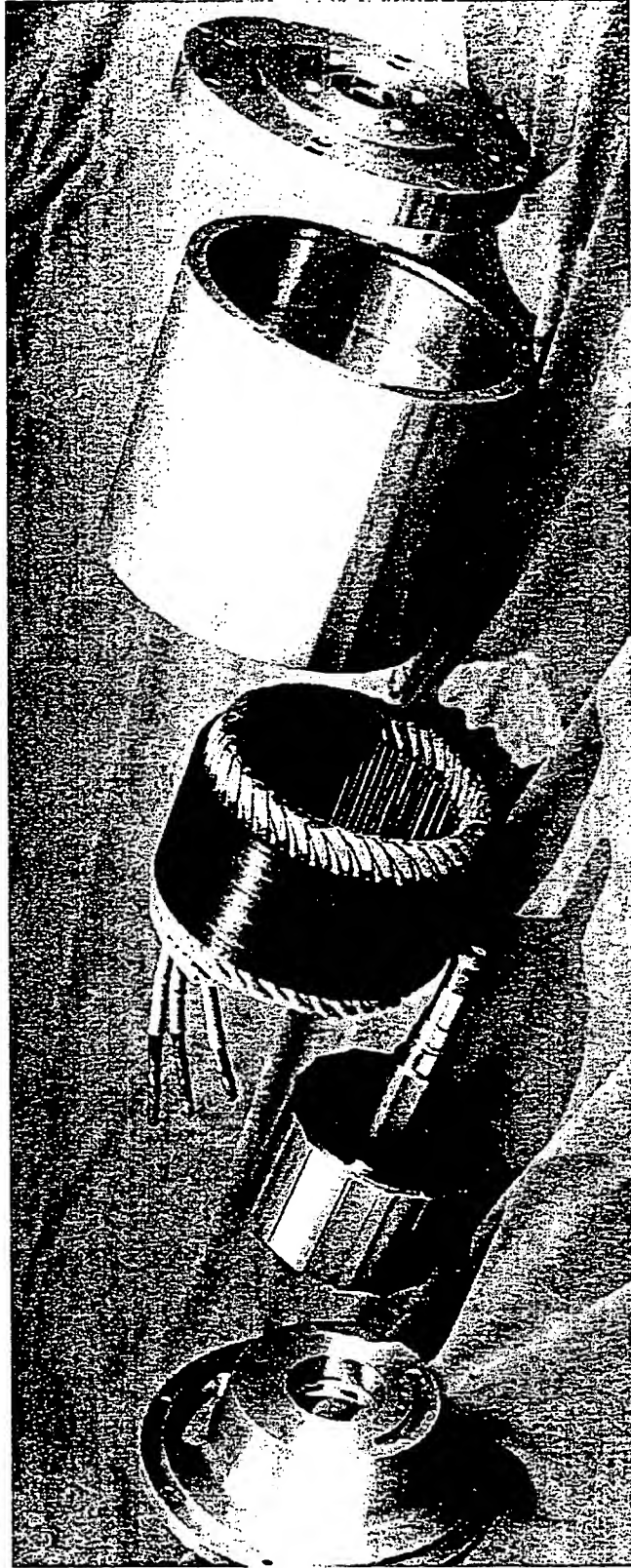


## Tomorrow

Differentiation

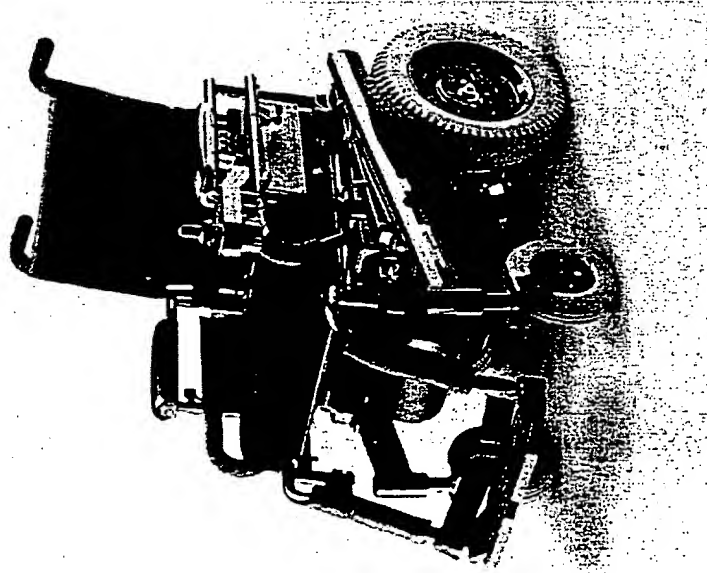
- Efficiency/range
- Performance
- Regenerative braking

# 10 HP Traction Motor

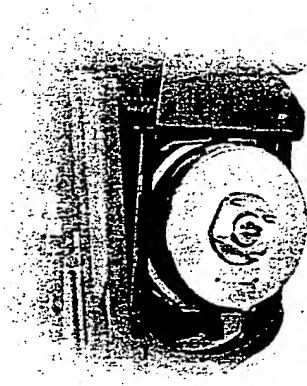


**WGM**

# UQM® Gearless Brushless (GB™) Wheelchair Motor

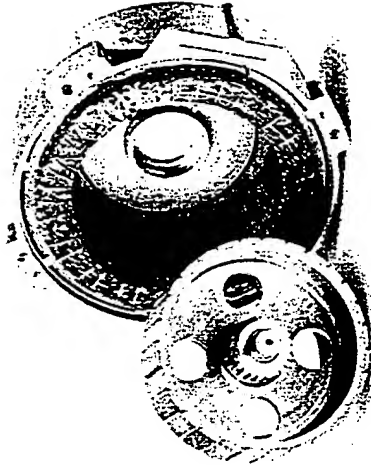


Invacare Storm wheelchair

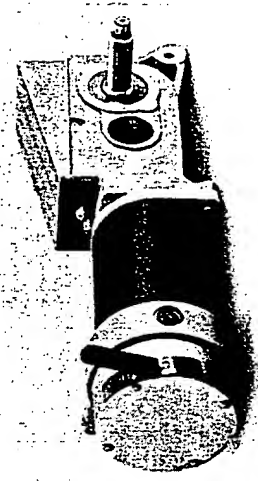


**UQM®**

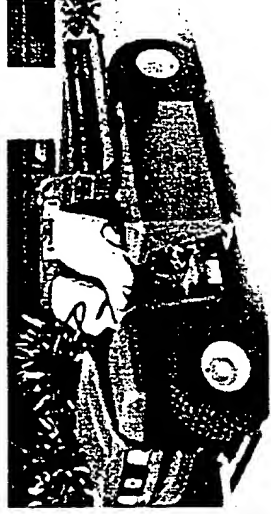
gearless brushless  
motor



Traditional  
power chair  
motor



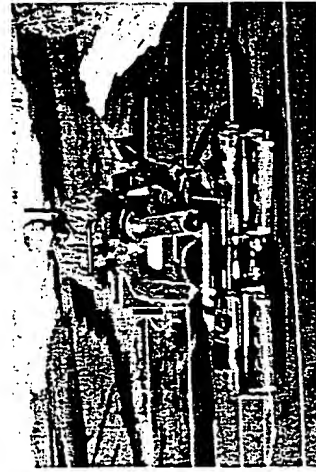
# Low Power Vehicles Emerging Markets



- Bicycles
- Motor scooters
- Go carts
- Lawn care products
- Neighborhood electric vehicles

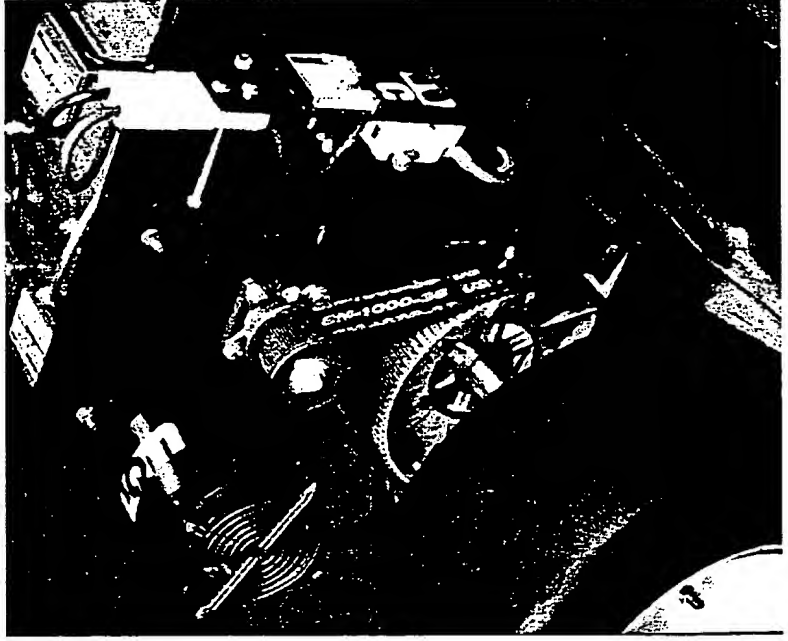
*Leapfrog existing technology*

- Power density
- Efficiency
- Performance



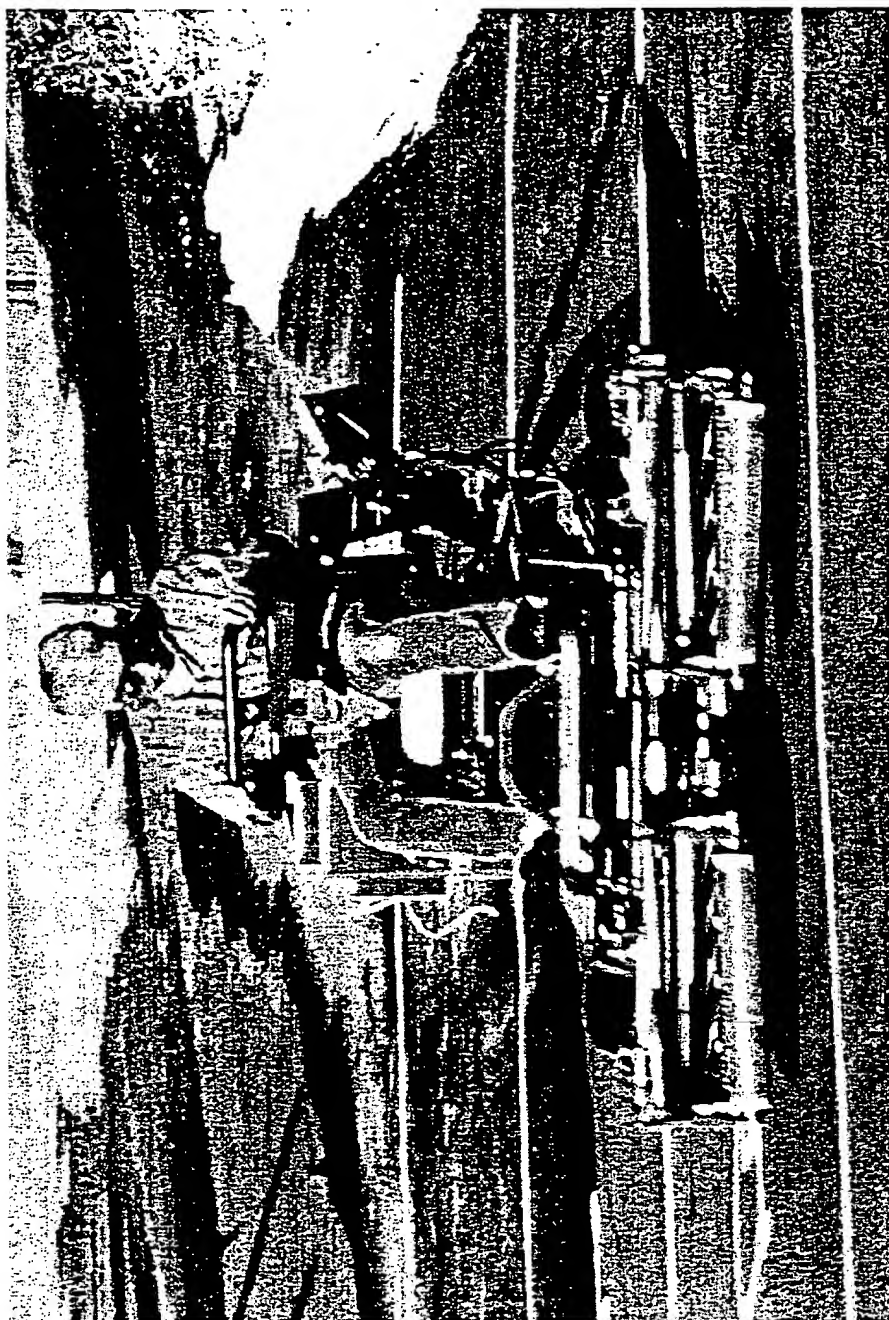
**UCM**

# Go Cart



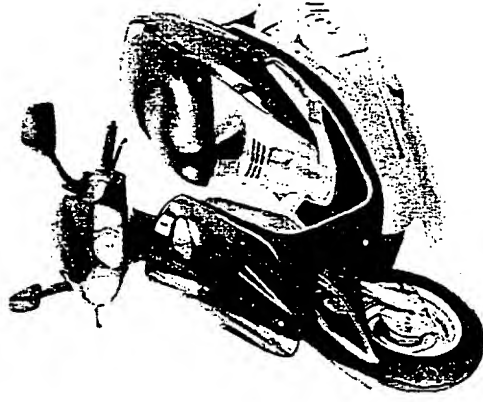
**LEON**

UOM



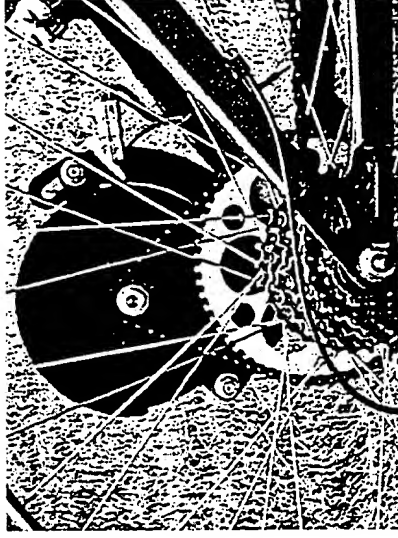
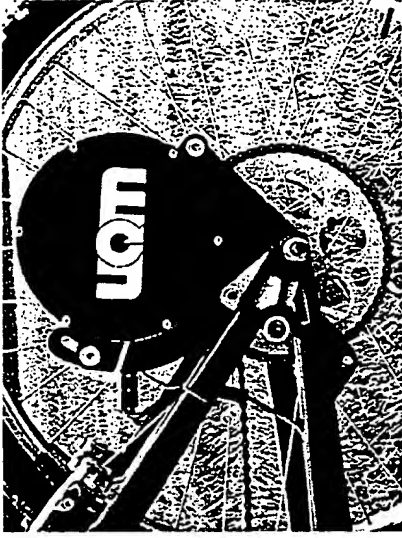
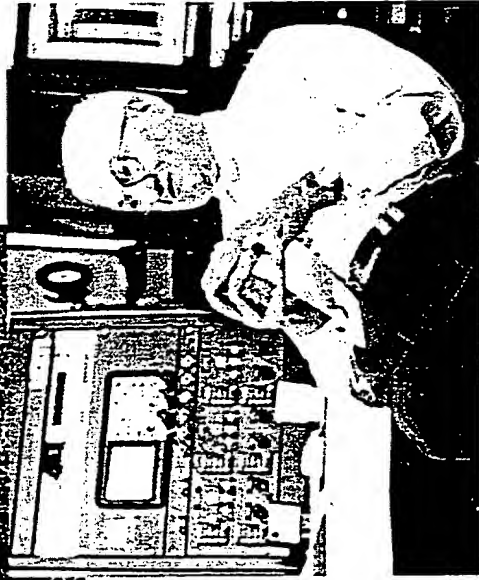


# Electric Scooter Drive System





# EVG Prototype Bike



**LGM**

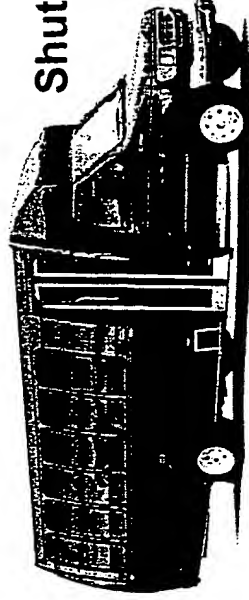
# High Power Hybrid Electric Vehicles

**HMMWV**



**SR218**  
32 kW (43 hp)  
drive system

**Shuttle bus**



**SR286**  
75 kW (100 hp)  
drive system

- **Military**

- **Bus**

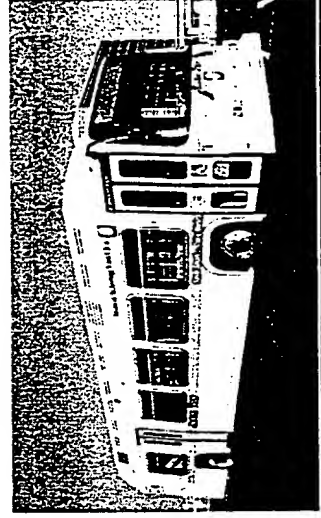
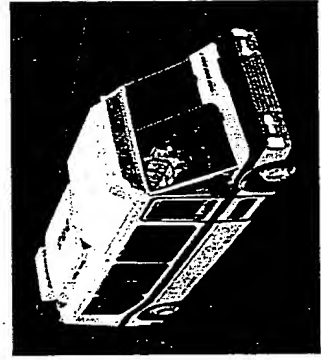
- **Truck**

- **Agricultural**

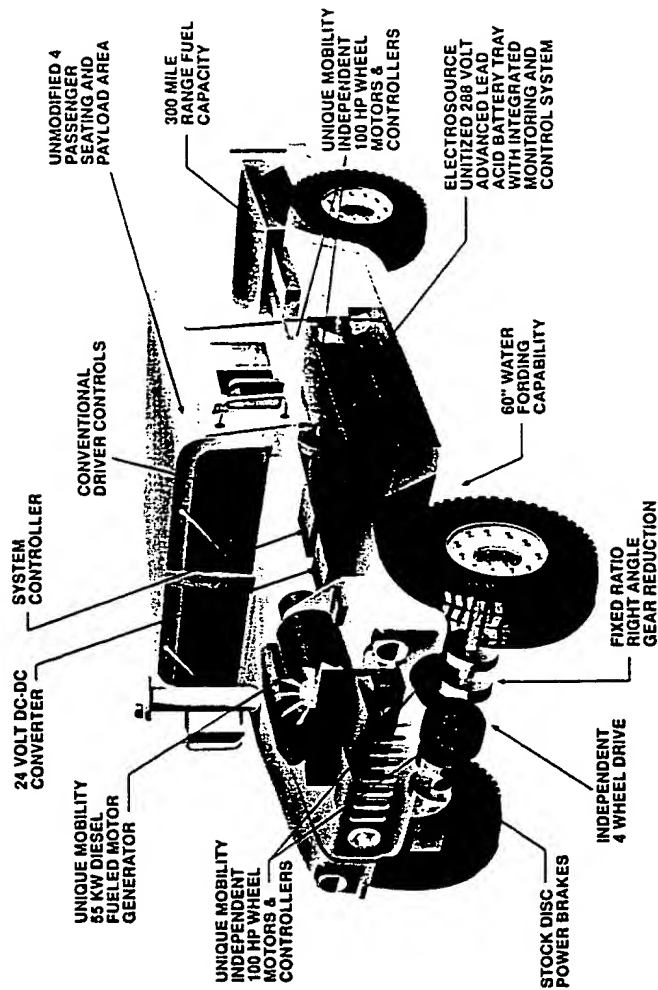
- **Construction**

- **Mining**

**Orion**      **ATTB**



# HMMWV



## HYBRID ELECTRIC HMMWV



# Strategy for Growth

- Aggressive product commercialization with large-scale manufacturing capability
- Strategic partnerships to access key markets
- Accretive acquisitions
- Maintain a technology lead

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